WHAT IS CLAIMED IS:

1. A liquid sensing system for a cooler for an aircraft using a two phase working fluid, the aircraft cooler circulating the two phase working fluid between a cooling heat exchanger and a chiller unit for cooling the two phase working fluid, the liquid sensing system comprising:

a middle liquid level sensor for detecting a middle liquid level of the working fluid and generating a middle liquid level signal;

a liquid temperature sensor for sensing temperature of the working fluid and generating a liquid temperature signal;

means for generating a flight phase signal indicative of a flight phase of the aircraft; and

a recirculation unit for receiving said middle liquid level signal, said liquid temperature signal, and said flight phase signal, said recirculation unit annunciating a working fluid system leak condition based on said middle liquid level signal, said liquid temperature signal, and said flight phase signal.

2. The liquid sensing system of Claim 1, wherein said recirculation unit only evaluates said working fluid system leak condition during a ground flight phase and a cruise flight phase.

3. The liquid sensing system of Claim 1, wherein said recirculation unit requires a confirmation time of said middle liquid level sensor to indicate the absence of working fluid continuously for 15 minutes to annunciate a working fluid system leak condition.

4. The liquid sensing system of Claim 3, wherein said recirculation unit additionally annunciates a system leak based upon a temperature indicated by said

liquid temperature sensor following the 15 minute confirmation time of said middle liquid level sensor.

5. A method for sensing leaks in a cooler for an aircraft using a two phase working fluid, the aircraft cooler circulating the two phase working fluid between a cooling heat exchanger and a chiller unit for cooling the two phase working fluid, the method comprising:

detecting a middle liquid level of the working fluid and generating a middle liquid level signal;

sensing temperature of the working fluid and generating a liquid temperature signal;

generating a flight phase signal indicative of a flight phase of the aircraft; and

receiving said middle liquid level signal, said liquid temperature signal, and said flight phase signal, evaluating a working fluid system leak condition, and annunciating said working fluid system leak condition based on said middle liquid level signal, said liquid temperature signal, and said flight phase signal.

6. The method of Claim 5, wherein said working fluid system leak condition is only evaluated during a ground flight phase and a cruise flight phase.

7. The method of Claim 5, wherein annunciation of said working fluid system leak condition requires a confirmation time of said middle liquid level signal to indicate the absence of said working fluid continuously for 15 minutes.

8. The method of Claim 7, wherein annunciation of said working fluid system leak condition is based upon said liquid temperature signal following the 15 minute confirmation time of said middle liquid level signal.

9. The method of Claim 8, wherein if the temperature indicated by the liquid temperature signal is greater than or equal to 13 degrees F., and less than or equal to 55 degrees F., then a minor system leak condition is annunciated.

10. The method of Claim 8, wherein if the temperature indicated by the liquid temperature signal is greater than 55 degrees F., then a major system leak condition is annunciated.

11. The method of Claim 8, wherein if the flight phase changes during the evaluation of a leak condition, the leak conditions are cancelled.

12. The method of Claim 5, further comprising sensing a bottom liquid level and generating a bottom liquid level signal, sensing pressure in a working fluid accumulator and generating an accumulator pressure signal, and sensing a discharge pressure of said working fluid and generating a discharge pressure signal, and annunciating a no working fluid failure condition based on said bottom liquid level signal, said accumulator pressure signal, and said discharge pressure signal.

13. The method of Claim 12, further comprising determining a differential pressure based upon said discharge pressure signal and said accumulator pressure signal.

14. The method of Claim 13, further comprising determining a pump airlock condition when said differential pressure drops below a predetermined pressure for a predetermined period of time.

15. The method of Claim 14, further comprising determining a pump airlock failure condition for a predetermined number of pump airlock conditions.